

Child Monitoring Using Geofencing and IoT

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Abstract—Child abuse and neglect are serious global problems which occurs in different situations, for a different range of reasons at different places. There are 90% of children undergoing devastating problem all over the world, where these factors may affect the child very seriously and cause a long-lasting, psychological damage. Everyone should be aware that victims of child abuse come from all socioeconomic background. Most of the abuse happens due to lack of knowledge and training in parenting skills. Preventing child abuse before it starts is possible and requires a cross-sectoral approach. In this project, we add up technologies such as IoT, NOIR camera and geofencing technique to reduce the child abuse ratio. This appears to be the best solution for parents to monitor their child activities and easy to find the abuser.

Keywords – Child maltreatment, Geofencing, IoT, ESP8266 Wi-Fi module, GPS module, NOIR camera, ThingSpeak.

I. INTRODUCTION

Internet of Things (IoT) refers to a vast number of things that are connected to the internet so they can share data over a network without requiring human-to-human or human-to-computer interaction. In today's world child maltreatment is a serious issue which should be controlled because a child can be abused physically, sexually, emotional or mentally. In US, more than 4 children die for the cause of child maltreatment and they are uncared on daily basis. Over 70% of these children are below the age of 3 to 5 and then boys (48.5%) and girls (51.2%) become victims at nearly the same rate. 2.9 million cases of child maltreatment are reported every year. 53% of children in India face some form of child sexual maltreatment and the cases of rape and murder of children increase every year. We often hear news about missing children reported in the media. Parents may not be able to monitor their children all the time, especially when they are going outside the house. This may cause the child to overlook and possibly they will be lost and misguided. This geofencing technique is used for parents or guardians to protect their children.

The geofencing technique is used to draw a virtual boundary covering the areas such as school, park, friend's house, etc. It automatically detects every object which enter and exit the virtual fence with the help of GPS. Geofencing

technique has been used for patients suffering from Alzheimer's disease [1]. Geofencing technique finds their applications in the department of medicine but also in numerous streams such as transportation, agriculture, marketing etc. In the proposed system we use NOIR camera which is used to find the abuser and their activities when there is any action towards the children. When the child moves out of the fence their parents will receive the alert messages. We know that child maltreatment has been increasing year by year. This device helps to reduce the harmful activity against children and it will be effective precaution for child maltreatment.



Figure 1. Stop child abuse

II. LITERATURE SURVEY

A. Smart Safety Device

Smart safety device uses a panic button, GPS module, and an Android Application. On encountering a dangerous situation, the child is instructed to press the panic button. This device takes the panic button as an input to make an alert and share the GPS location of the child to the parent or the caretaker. The drawback of this device is that, the child finds it difficult to sense the situation and press the panic button at the right time.

B. Wearable Device for Child Safety

This wearable device involves GSM Module, heart beat pulse sensor, temperature sensor, humidity sensor. Once the pulse of the child increases the device checks for the temperature and humidity of the child to identify the child's condition. If the temperature and pulse is higher than the normal rate the device sends the location of the child via the GSM module and Wi-Fi module. For a child the pulse rate need not remain normal all the time as the child involves in activities like playing, running which leads to increase in pulse rate so this device may generate an alert even when the child is running or playing, document.



Figure 2. Safety device

C. Smart IoT Device for Child Safety

This is one of the existing methods of child safety tracking, this system uses LinkIt ONE board, temperature sensor, touch sensor, serial camera, heartbeat sensor. Every 30 minutes the data of temperature sensor, touch sensor and pulse rate sensor and GPS are taken to the cloud. The data is compared with the threshold value and when the data exceeds the threshold an MMS which is captured by the serial camera consisting of child background is sent to the parent mobile. This gives the live tracking of the child every time when the data from the sensor exceeds the threshold value.

D. Security Tracking using Bluetooth and GPS Module

The security tracking system uses Bluetooth, GPS module, GSM and Arduino. The Bluetooth module which is present in the system is connected to the Bluetooth of the parent's or the caretaker's mobile. When the disconnection of Bluetooth module and the mobile occurs, the GPS tracks the location and sends the coordinates of latitudes and longitudes to the parent or the caretaker. The Location of the child can be tracked every time, when the Bluetooth disconnects. The time interval for each new location of the child can be modified by the user.

E. RFID and GPS Antennas Tracking System

In RFID and GPS antenna tracking system, RFID antenna, GPS antenna, RFID reader is used. RFID and GPS antenna are designed in such a way that it tracks the child on wearing the system. This gives live sharing of the child's location to the parent or school management so that the parent can have an eye on the child and save them under the circumstances of danger.

III. PROPOSED SYSTEM

A. Geofencing

Geofencing technique is said to be a location-based technique, which works using the RFID, GPS, Wi-Fi or cellular data. Geofences are said to be the virtual boundaries, entering or exiting these boundaries triggers an alert message. Parents must select and mark off a geographical area on the map which are frequently visited by their children or the places which are considered as prohibited for their children. Once a geofence is activated, the system can trigger any action, as defined by you, when the user enters, exits or wanders in the particular geographical location.

Geofences find a variety of applications in various departments due to their ability to track every individual based on the location. Types of geofencing falls under two categories. One is active geofence, whose control is defined only for the end users wherein the location services are used to track a particular individual. The other is the passive geofencing in which the system is turned on all the time. The entire tracking leans on the internet connectivity replacing the cellular connection.

Geofencing finds their major application in medical field for tracking a person who is suffering from Autism disease. The patient tends to suffer from memory loss. A mobile application which has numerous options based on geo fencing has been developed in order to help them. It comprises of features such as find a friend, which gives the direction of a friend nearby. The application also provides way to home option which directs the patient to their home and an alert is also programmed, which triggers an alert message both to the caretaker and the patient for every fixed interval of time.

Geofences are used for the purpose of tracking vehicles by the owners so that they can have an eye on their drivers. They find a vital role in transport of materials between large industries.

The virtual boundaries also find application in marketing where their promoters create geofences and advertise regarding the products to the people who enter into their boundaries.



Figure 3. Geo fencing

B. Raspberry pi 3

The size of the raspberry pi is as small as credit card. It is a single board that has the ability to interact with the outside world. It has a 40 pin GPIO (General Purpose I/O) connector, any of the GPIO can be used as input and output pin for a wide range of purpose. The Raspberry pi is programmed by using python. Raspberry pi 3 has 1GB SDRAM and it has 4 USB (0.2) ports for multiple connection. It has a separate slot for camera. The DC power supply of Raspberry pi is 5V. Raspberry

pi has Bluetooth and Wi-Fi for wireless connectivity. This model consists of 2.4GHz (802.11n) wireless LAN and 4.1 Bluetooth classic. By using this there will be no issues to connect wireless device or connect through online.



Figure 4. Raspberry pi 3

C. GPS Module

GPS (Global Positioning System) is used around the world for finding the location, navigation, tracking, and mapping. Here, the communication between the Raspberry pi and GPS module is used for reading the latitudes and longitudes using a Global Navigation Satellite System. For connecting the GPS module to Raspberry pi we need to use the receiver and Transmitter pins of the shield. It requires the power input of 5V 100mA, which can be provided using any suitable device. Using this GPS data we can point the faultless location on Google maps.



Figure 5. Wi-Fi module

D. NOIR Camera Modulev2

The NOIR (NOIR – NO InfraRed) camera is used for capturing images and videos like normal camera with an identical difference that, it doesn't have infrared filter. The size of the NOIR camera is 25 millimetres * 23 millimetres *9 millimetres which weighs 3 grams. It has a high quality of 8 Megapixel Sony IM219 image sensor. These Cameras are capable of capturing static images 3280*2464 pixels and videos at 1080p30, 720p60, 640*480p90 resolutions. To connect NOIR camera with the raspberry pi 3, locate the pi camera serial interface (CSI) and insert it. It captures image continuously heedless of day and night (light and dark background).

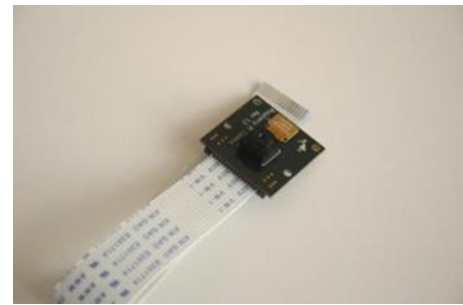


Figure 6. NOIR camera

E. ESP8266 Wi-Fi Module

ESP8266 is a wireless serial remote integrated chip of connecting device. This Wi-Fi module will communicate with networks like Transfer Control Protocol (TCP) or Internet Protocol (IP) stack and 802.11 networks. It is a low-cost chip with the capability of 32-bit microcontroller, and they are 16 GPIO (General Purpose I/O). The voltage used for communicating interface is 3.3V with 240mA (MAX) current. For connecting ESP8266 module to the Raspberry pi, and similarly connect the Transmitter (TX) to Receiver (RX) and Receiver (RX) to Transmitter (TX).



Figure 7. ESP8266 Wi-Fi Module

F. ThingSpeak

ThingSpeak (an IoT application development platform) is a direct service that allows you to visualize and cluster live data in the real time. The data analysis is done by executing MATLAB code in ThingSpeak. Here, the data is stored in the channels where each channel can store 8 fields of data and you can create as many channels as you want. The data is stored either in public channel by default or private channel to share data with others and private data is protected with an API key. You can also read your data through CSV or JSON using REST API. ThingSpeak can fetch the data directly from the CSV file. It stores all the information which has been received in one central location in cloud and the data can be sent within seconds. So, you can access your data through offline and online through web browser or mobile device.

G. Raspcontroller

Raspberry pi is easily controlled by RaspController through mobile or tablet. In this we can control GPIO ports, file manager (traverse the content of Raspberry pi, copy, paste, delete, download), and which we can enable camera in which we can view images and video, which is connected to Raspberry pi, secure shell (SSH) which is used to send custom

commands to your Raspberry pi, it will read all the information of the connected device using info Raspberry pi. Using this RaspController we can shut down and reboot the system.

IV. BLOCK DIAGRAM

The block diagram of the proposed system is a plain sight, which explains the flow of data between the connected devices and the functioning of the system in detail

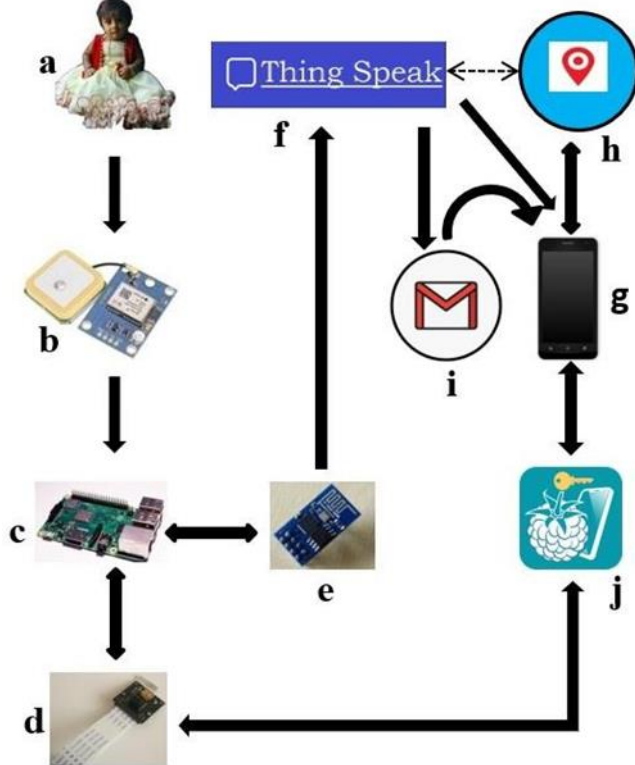


Figure 8. Block diagram

V. FLOW CHART

Smart IoT devices can be connected to platforms like ThingSpeak using the execution of MATLAB code. The role of IoT development platform is to make a continuous analysis of data from the connected devices. Using IoT protocols, the easy configuration of the device with the ThingSpeak takes place. The data from the device can be continuously monitored. With the help of this monitoring many alert systems can be built.

GPS module is used for the calculation of geographical position of a device and this is done with the help of information received from the GNSS satellite.

RaspController is an android application which gives the complete control of the IoT devices in the hands of the user. It has numerous applications like enabling camera (Capturing pictures, streaming a live video, etc.), voice recording devices, memory of the Raspberry pi, control of GPIO, CPU, RAM, disk monitoring and the other sensors.

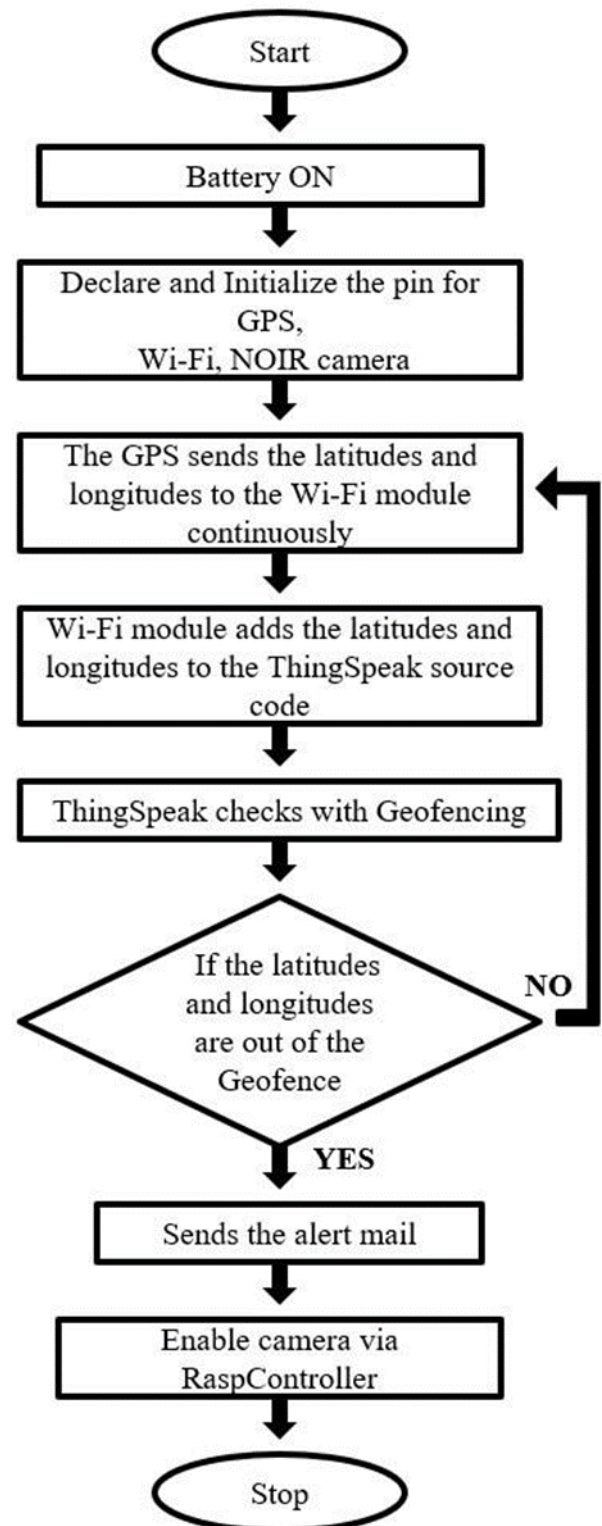


Figure 8. Flow chart

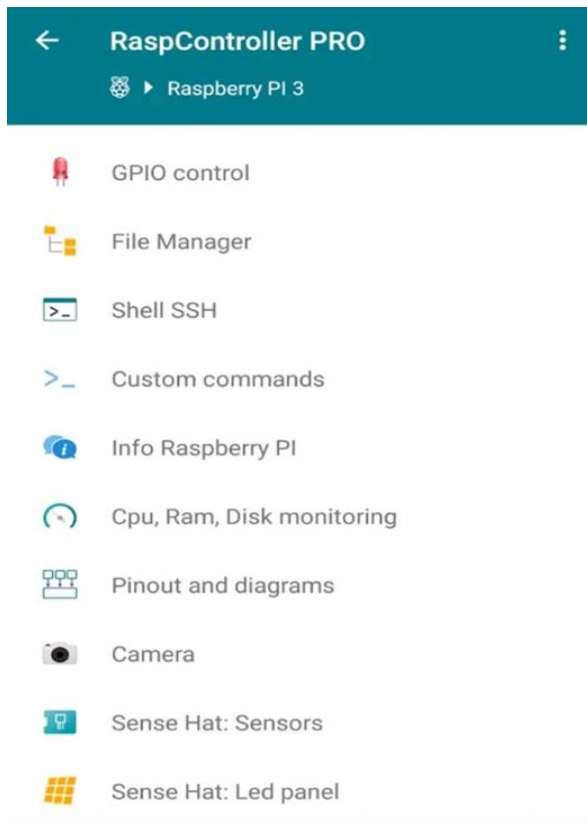
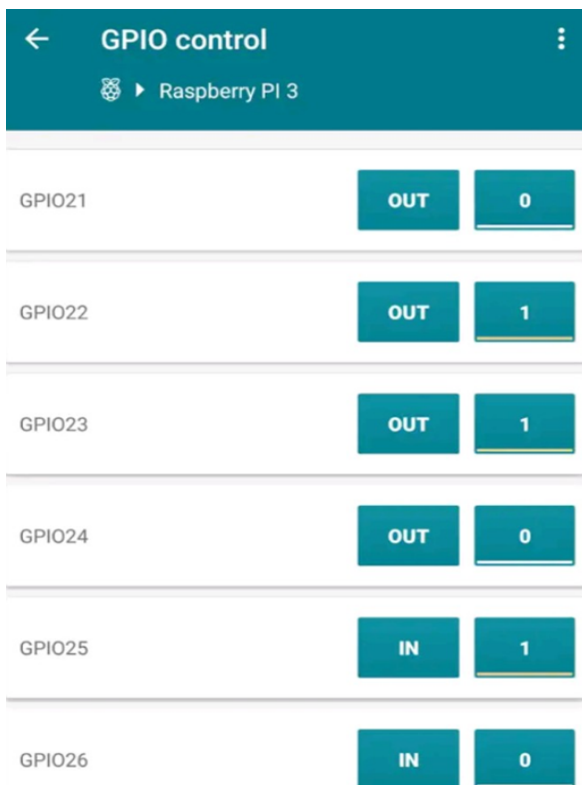


Figure 9. Options in raspcontroller



9. I/O control of raspberry pi

VI. CONCLUSION AND FUTURE ENHANCEMENTS

This project demonstrates child monitoring using Geofencing and IoT, wherein the parents can keep track on their children. The system behaves as a complete alert system and every time when the child moves to a location without the knowledge of the parent. This eliminates the parents from being dreadful. Hopefully the proposed system finds the solution to the major cause of child maltreatment. This system can prove to be a efficient safety device for the children. Adding to the feature of the Child safety using Geofencing and IoT device, the safety can further be brought by a RFID based electronic lock so that only the parents can remove the belt with the help of RFID tags. Moving a step forward, if the parent finds his/her children in danger can send an alert message to the friends nearby so that they can save the child.

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